Comanant coracoid # 463'2
from CIT loc. 5-05 (= LACM 1136)
Goleta Fm. Pliocene, near
Morelia, Michoacan, Mex.

(a) Length (head to sternal angle) 42.8
(b) Br. at & bet. scapular + glenoid facet to opposite edge of bone, 17.9 mm, ratio br 16.8% Ratio br 50.6
(c) Distance from below scap. facet to head — 15.6
(d) Least transverse width below scap. facet 7.6
(e) Distance from int. edge to intermuscular line at ~~distal~~ sternal end — 9.3 Ratio ea 19.4 ca 32.6% da 7.5% (B)

A — Jaque mean, in Pl. oliveacea-mex, + P. petaq. (B)

	A	#1293 B (min. of 4 Sal Bed)	#340 max. of 4 San Pedro	#2778 front + chapalaco
a	— 53	53.5	58.8	—
b	— 7.4	8.3	9.7	— 8.0
c	— 17.8	19.2	21.2	— 17.4
d	— 3.4	3.5	4.3	3.7
e	— 7.5	11.0	11.8	—
Ratio ba	14.3	-15.5	ba 14.4	Be 45.8
ca	33.5	-35.9	ea 36.1	
da	6.4	-6.5	da 7.3	
ea	14.1	-20.6	ea 20.0	
Be	42.6	Be 43.3	Be 45.7	

The distance of the intermuscular line from the internal border is important; in living comanants, P. carbo + P. auritus + P. oliveacea-mex have this distance small, whereas in P. pencillatus + P. pelagicus it is greater — the fossil resembles these latter two.

Goleta Comanant pubd n. sp. — 55'
So Calif Acad Sci Bull. 64(1): 50
1965 Howard

Over Chapala Comanant

Comparative measurements of 2778 from loc 1129
Chapalote, Salina, Nev.

Similar to Ph. auritus & Ph. alivaceus as distinguished from Ph. pelagicus & Ph. penicillatus in less anterior prominence of middle tubicle & greater extension of this tubicle toward proximal rather than abrupt depression terminating it

	fossil	1330 Ph. alivac	4/167	mus. Ph. pelag	1293
Length —	50mm	48.5	48.8	51.0	
	9.5a +	9.9	10.1	10.6	
aphm. prox. to, to dist. condyles (not including tip of internal)	10.9a	11.8	12.0	12.8	
		4.4	4.7	4.6	
to sh. mid below	5.0				
muscle scar ant-post depth mid foot	5.1 (4.2 in groove)	5.7 (4.4 in groove)	in groove 4.8	5.7	6.2

Internal calcaneal crest rises from shaft more abruptly than in all except Ph. alivac. (not remembered & terminates more angularly (in latter respect is alike Ph auritus

Fossil # 2778 is very slightly excavated antly below head, even less than in Ph. auritus & Ph pelagicus but slightly more than in Ph. alivaceus. Muscle line down shaft from tuberosity (ant ly) is more medially placed than in alivaceus & straighter than in any Rec. specimens of all sps. at hand

tuberosity less deep ant-post than P. olivia (nearest P. pelagicus. Rugosities of tuberosity should be carefully studied (much less rugose than penicillatus)

Coarse 2778 has marked two constricted indentations below head dorsally (post) one in pelagicus; ext. side) head area well excavated as in alivac. & auritus (less in pelagicus, more in penic.)

CIT 505, Fam 1136 Goleta, Michoacan Peruvian

1136 (TD fieldbook 5/5/55 (p. 101)
TD 474)

Partial jaw & incisors of cricetine rodent - mixed with red sands of ant hill

TD 475 - misc. vertebrate bones in surface just below diatomite matrix but & above 474. Also partial carnivore jaw with some lower teeth

TD 476 - 2 Nannipus lowers & misc. frags.

TD 477 Ant hill material includ. fossorial incisors

TD 478 Nannipus M3 weathered out at same level as 477, with matrix

TD 479 - Rodents from ant hill above bird bone

All the above = 1136

Ant hill material may be older as sand grains brought up by ants are not in evidence in exposure

505 Galeta # 2 Morelia lacustrine Basin
"Galeta fm", East of Morelia,
State of Michoacan, Mex. Most
northerly barranca on W. side of
north draining basin, 3/4 mi. SW
Colonia Miguel Hidalgo.

Fossils in clays of badlands exposures
so. side barranca, up to 7' above diatomite
+ 10 ft below it (Clotted consolidated sandstone
with proboscidean remains + a bird
bone around) = LAM 1136 see TD field book p101
5/5/55

506 A + B in next barranca so of 505
on west side of basin, fossils in
lt gray to buff clays, 2' above + 2' below
diatomite "Galeta # 3"

507 (Galeta # 4)
next barranca so of 506 A - Balsa
on W side of Basin, fossils in
buff colored clays immed'ly above
diatomite. Prolific rodent loc.
Galadon (Mastodon jaw frag + M3)
Pleurolicus P2 + Rincay? Infusorian
found in consolidated calcareous layer
7' thick, 15 ft above diatomite in
upper reaches of barranca

Age Hemphillian (Mid Pliocene)
excavations by CIT 1950 Tedford + Schultz
GHQ, Stock

Phoxinus

Michoacan

Mexico

n. sp. Commarch

P. Soletensis

So. Calif. Acad. Sci. Bull. 64: 50-55, 1965

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DEPARTMENT OF GEOLOGY

RIVERSIDE, CALIFORNIA 92502

October 5, 1964

Dr. Hildegarde Howard
Los Angeles County Museum
Exposition Park
Los Angeles, California 90007

Dear Hildegarde:

The report that you found with the Goleta collection was prepared for Chester Stock as a summary of our activities on his behalf in that area and was never published. There are only two published references to the locality:

Arellano, A. R. V., and Azcón, E. , 1949. Pre-Equus horses from Goleta (Morelia) Michoacán, Mexico (Abstract). Bull. Geol. Soc. Amer. 60: 1871.

Repenning, C. A., 1962. The giant ground squirrel Paenemarmota. J. of Paleo. 36:540-556 (see particularly pages 554-555).

Arellano and Azcón announced the discovery and stated that Gazin had suggested a Blancan age; Stirton, Hemphillian and Hibbard cautioned that the assemblage as known did not preclude an early Pleistocene age. Repenning tentatively accepts a Hemphillian age, but quotes me as of the opinion that it is Blancan. I still hold this opinion. I have compared the Goleta fauna with the Ypomera (late Hemphillian; Stock often referred to this fauna as "Rincon") and Miñaca (late Blancan) faunas of Chihuahua and feel that it stands between those two in age. It is thus early Blancan.

This summer Frank Kilmer, George Jefferson, and Dave Whistler spent a week on Cedros Island, Baja, collecting in the late Pliocene marine deposits which carry a San Diego formation-like molluscan fauna. These beds are very rich in marine vertebrates, including birds. I've been able to identify Mancalla from beautifully preserved bones. The next time I come in to LACM I'll bring the bird bones with me.

My very best wishes. Hope to see you soon.

Sincerely,

Dick

R. H. Tedford
Asst. Professor

RHT: mlh

Coronoid height / depth

shaft in olivar / easie breaker relative to breath / condyles / depth-shaft

Coracoid prominence

P. pelag.	a Br dist end	b Br across dent. condyles only	c Depth dist end	Ratio cb	d br sh at prox tip trach impress	e depth sh prox tip trach in	Ratio ed	Ratio eb	Ratio db	Ratio ec	Ratio ba	depth ext nit condyles	a length head straight down	b length head to nit. tip stemal end	c nit. Br. at glenoid-scapular joining	d Distance intermuscular line from nit. edge measured at upper level of sternal facet	e upper length below scapular facet to head	Ratio ce Ratio cb	Ratio db	Ratio eb
824 ♀ San Pedro	13.2	11.0	9.7 10.5 / 9.4	88.3	6.7	5.5	82.2	50%	60.9	56.4	84.4	9.4 / 10.7	58.15	58.0	9.05	13.0	20.7	43.6% / 15.6	22.4	35.7
453 ♀ San Diego	12.3	10.8	9.5 10.3 / 9.4	88.0	6.5	5.5	84.6	50.4	60.2	57.9	88.5	9.3 / 10.3	59.3	59.4	8.9	12.5	21.0	42.4% / 15.0	21.0	35.4
3468 ♂ San Ped.	13.3	11.7	9.9 11.0 / 9.8	87.4	7.3	6.0	82.3	54.1	65.6	60.0	85.4	9.7 / 11.0	59.2	58.8	9.7	12.0	21.5	45.1% / 16.5	20.4	36.5
1293 ♀ Seal Beach	12.1	10.1	9.2 9.9 / 8.9	90.9	6.3	5.1	81.0	50.5	62.4	55.4	86.3	8.8 / 10.0	53.95	53.55	8.2	10.8	19.1	42.9 / 15.3	20.2	35.7
P. olivac. ♂ 1376	11.8	10.0	8.8 10.1 / 8.9	88.0	6.8	4.9	72.1	49.0	68.6	55.4	85.4	8.7 / 9.9	53.5	52.9	7.55	7.7	17.9	43.4 / 14.25	14.55	33.9
fossil Plio Mex 3166	10.6	8.9	7.6 8.5 / 7.4	8	6.0	4.4	72.1	50.0	69.3	58.7	[illegible]	7.35 / 8.85	47.8	47.75	7.1	9.5	14.3 / 13.1	46.1 / 14.85%	20.0%	32.2
P. anitus Lake Buena Vista 257 sm?	15.7	13.55	11.8	87.5	8.5	6.75						11.5 / 13.1		66.35	10.6	10.3	23.9	44.5 / 14.0	15.5	36.1
Del Rey, Calif 382 ♀	15.0	13.0	10.9	84.1	8.0	6.0			61.6			10.7 / 12.0		67.5	10.55	10.8	23.3	45.3 / 15.0	14.8	36
Chino, Calif 1140 ♂	15.2	13.1	12.0	91.5	8.65	6.5						11.2 / 12.9		66.7	11.35	10.1	23.8	47.6 / 17.1	15.1	37.1
P. peninsularis almost 670 sm?												9.6 / 11.3		62.3	10.2	12.1	22.5	48.6 / 16.4	20.4 / 6.4	36.2
497 Del Monte?												10.0 / 11.3		60.6	10.1	12.4	22.2	45.7 / 16.4	20.9 / 6.6	36.6
692 Del Monte?	14.9	12.9	11.4		7.8				60.5			10.4 / 12.3		67.4	11.7	14.4	24.0	47.5 / 16.9	21.5 / 6.7	35.6
San Pedro 458 ♂	14.6	12.4	11.4		7.8				62.6			10.5 / 12.2		67.1	10.8	12.8	23.95	45.3 / 16.0	19.0 / 6.0	35.5
San Pedro 356 ♂	14.2	12.4	11.5		7.9				63.6					68.4	11.0	12.7	23.5	45.0 / 16.1	18.6 / 6.0	34.4
fossil from Lake Chapala	12.5	9.99	8.2?	83.0	5.7	4.35	77.6		57.6			8.2? / 9.3?		—	8.0	—	17.5	45.6 / —	—	—
P. olivac. MVZ 46167 ♂	12.0	10.0	9.2 10.2 / 8.8		6.2	4.9	80.5		62.0			9.1 / 10.1		53.7	—	8.3	18.0	—	15.4	33.5
" " MVZ 89508	11.8	9.4	8.5 9.4 / 8.3		6.1	4.7	78.3		64.9			8.6 / 9.1		51.1	7.5	7.5	17.2	43.4 / 14.4	14.6	33.5
" " MVZ 126084	11.0	9.5	8.2 9.3 / 8.1		6.4	4.4	68.7		67.4			8.35 / 9.25		50.0	7.3	7.6	17.1	42.1 / 14.4	15.1	34.2

See GSA Bull 60 (Dec, 1949) p. 1871 Arellano + Ageon (Morelia vertebrate)

Abstract of El Paso GSA meeting of Nov. 1949

Title, Pre-Equus horses from Guleta (Morelia) Michoacan, Mexico

30-40 metres of "presumably Pliocene" diatomaceous, tuffaceous + clayey sediments are exposed with The Tacubaya – weathering features at the top. Becerra (late Pleisto) of central Mex. not developed here as in Mex. City Basin.

1948 Ageon collected horse teeth in clay, 10 ft above diatomaceous bed with proboscidean remains. In June 1949 both authors collected more horse teeth + studied stratig, Ageon ident. horse teeth as Nannipus of montezuma + Pliohippus sp. suggesting Blancoan [sic] age. Stirton concurred on Nannipus but thought the others more properly Pliohippus (astrohippus) of asbornii and most likely were Hemphillian. Hibbard says both genera range in Kansas into the Meade [Meade?] fm which is basal Pleistocene so cannot be considered diagnostic of Pliocene.

Stratigraphically is capped by Tacubaya upturned to early Wisconsin by Bryan

Coracoid contd from ruled sheet

	bf facets	ratio fa/	bcg procoracoid to scapular facet	Rafting gb	bf to head marg ext.	ratio fb/	h e glene			Xe	
								dbasic top glenoid	dhead		
824	11.3	54.5	5.5	48.6	9.3	19.4	44.9	26.8	12.0	58.0	20.7
453	10.85	52.6	5.0	46.1	9.1	18.3	43.1	23.8	12.7	60.6	21.4
346	11.35	52.7	5.4	47.6	9.5	19.3	45.0	25.0	12.2	56.8	20.7
1293	10.2	53.3	4.9	48.0	8.25	19.1	45.1	25.6	11.6	60.7	21.6
1376	9.7	54.6	5.1	52.3	8.8	18.3	49.6	28.6	9.8	54.7	18.5
4632	8.9	57.7	4.5	50.6	7.5	18.4	48.6	29.2	8.1	52.6	16.9
257	13.0	54.4	6.8	52.3	11.8	20.0	49.5	28.6	13.0	54.4	19.6
382	12.4	53.3	6.5	52.4	11.3	18.4	48.5	27.8	13.0	55.7	19.2
1140	12.2	51.3	6.6	54.1	11.4	18.3	48.0	27.7	13.3	55.8	19.9
620	11.2	49.7	6.85	61.1	9.9	18.0	43.0	30.4	13.5	60.0	21.6
497	11.55	52.1	6.5	61.4	9.8	19.0	43.1	29.3	12.7	57.3	20.9
692	12.3	51.2	7.65	62.1	10.8	18.2	45.0	31.8	14.3	59.6	21.2
458	12.3	51.4	7.05	57.4	10.7	18.2	44.7	29.5	13.7	57.4	20.3
356	12.9	52.6	7.15	55.5	11.0	18.8	46.8	30.4	13.8	58.7	20.2
Chapala fossil	10.1	58.0	4.4	43.5	7.5	—	43.1	25.1	9.7	55.3	
olivaceus											
46167	9.6	53.3	5.0	52.0	8.3	17.85	46.1	27.9	9.9	55.0	18.4
85508	9.6	55.5	4.8	50.0	7.95	18.7	45.4	27.7	9.1	53.0	17.8
126084	9.4	54.6	4.65	49.5	7.55	18.8	43.9	27.0	9.4	54.9	18.8

Keep

pelag. female procoracoid (90 upper lip 23.8–26.3)
sospinit larger " (90 29.2 [element ♂ penic. or olivac.
olivac, large "
penic, large "
auritus like olivac.
Chapala small

27–28.6 90
29.3–31.8 90
27.7–28.6
25.1 bent w shaped like pelag, with bulge across below the joint

Keep of Her Side

nearly complete

Type: 1 right coracoid, ~~Loco Mus. No. 4632~~, lacking only sternocoracoidal process; Los Angeles Co. Mus. no. 4632.

Locality and Age: Calif. Inst. of Technology locality 505 (equivalent of Los Angeles Co. Mus. loc. 1136); Morelia lacustrine basin, east of Morelia, Michoacan, Mexico; most northerly barranca on west side of north drainage basin, 3/4 mile southwest of Colonia Miguel Hidalgo; ~~in slightly consolidated sandstone~~ about 10 ft below stratum of diatomite, ~~Layer marked~~ ~~Neuphlbilian~~ Mid Pliocene; Neuphlilian.

Diagnosis: small coracoid with (1) narrow, well marked depression of neck (external view), (2) head flared above glenoid facet and (3) short proximodistally, (4) lower and (post.) well above glenoid facet, with abrupt median bend from glenoid to fucular facet; (5) procoracoid moderately prominent; (6) anterior intermuscular line set well in from internal border at its distal extremity; (7) stenocoracoidal angle well developed + pointed; ~~In comparison with the two small coracoids from Morelia~~ ~~Modification, described~~

Description:— Flaring of head above glenoid facet (as viewed ext'ly), and depth of depression of neck as in P. olivaceus; + The lateral ~~markedly different from that in P. pelagicus in which the base of the area above the glenoid facet (as viewed ext'ly) is nearly parallel to the~~ parallel sided contour. The ~~surface of the~~ is shallow with ~~a~~ ~~broad~~ relatively ~~straight~~ contour. development of procoracoid also ~~nearly~~ absent to ~~that~~ ~~in~~ ~~Drawing~~ always ~~slightly shorter in vertical extent~~. Markedly distinguishes from ~~both~~ P. olivaceus + antero-lateral ~~by~~ more lateral position of intermuscular line; ~~In this respect~~ ~~P. olivaceus resembles P. pelagicus in that the~~ line is well median in position; The fossil more closely resembles P. pelagicus in this one character. ~~Differences from~~ P. pelagicus ~~are~~ differs markedly, however, in lack of flare of head + very shallow neck region. ~~The head area above the glenoid facet is~~ In shortness of head and abruptness of median bend ~~the~~ in this area the fossil differs from all four ops of comparative living Mex. Today (P. pelag., P. olivac. P. auritus + P. penic.)+

	Humerus		cortical		meas. continuo			Depth above int cond.	Length brachial artery	Diagonal	hi
	Ht ext cond	Ht int cond	Depth ext cond	Depth int cond	Ratio hf	Ratio	Dist to top lig. attach. caput palmaris sup. – on pubis 10.3–11.0				
pliopies											
826	10.0	5.8	9.4	10.5	95.0%	97%					
453	9.55		9.3	10.2						90.9	
							11.1–11.8			89.5	
346			9.8	10.8			10.9–11.8			90.6	
1293	8.9	5.6	8.9	9.7	100.0		10.3–11.2	5.6	14.2	91.9	
Livac.											
1376	8.6	4.95	8.7	10.0			9.3–9.7	5.6	12.6	87.0	
fossil	7.17	4.5	7.4	8.8			8.2–9.0	4.8	11.0	84.0	
Amuth											
257			11.6	13.2						87.9	
382	11.3		11.1	12.3						91.1	
1140	11.3		11.7	12.9						86.8	
punic											
670	10.3		9.8	11.3						85.6	
497			10.1	11.3						89.5	
692			10.6	12.3						86.3	
458			10.5	12.1						86.8	
356	11.0		10.9	12.3						88.7	
Chapala			8.2 or 8.0 ?	9.6 or 9.7 ?						82.4 ? 85.5 ?	
1012										88.0	
46147			8.8	10.0						89.3	
85508			8.3	9.3						88.0	
124088			8.1	9.2							
obisbo.											

88
92)810
736
740
736

84.0
88)740
704
360
352
80

84.0
88)740
704
360
352/80

Pampean age = RLB

Vert. Paleon. + continental stratigraphy in Colombia

Stirton, 1953 Bull. G S A 64: 603-622

chart p. 606

Literature cited

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1933. Handbuch der Palaeornithologie. Berlin, Borntraeger, xlx plus 1022 pp.

Distribution P. oliv.

P. ol. mex. NW Mex & Louisiana, so & Nicaragua
+ Bahamas, Cuba, Isle of pines.

P. o. oliv. - Coasts, lakes, rivers of Cent. + So. Amer.
from Nicaragua & + inna del Sur

Phalacrocorax galetensis n. sp.

Type: Nearly complete right coracoid lacking only the sternocoracoidal process; R.M.C.M. no. 4632, collected by R.T. Tedford & R.L. Shultz, Calif. Inst. Tech. party, 1950

Locality and age: Calif. Inst. Tech. loc. no. 505 (equivalent of Lacm loc. no. 1136); west side of north drainage basin, 3/4 mile SW Colonia Miguel Hidalgo, Morelia Cuautitlan basin near Barranca on west side of valley of Morelia, Michoacan, Mexico, Tenencingo Blancan (?) age, diatomite stratum, Galeta formation; Pliocene (?) or early Pleistocene (?)

Diagnosis: Small coracoid with narrow but well-marked depression of neck (external view); head slightly flared above glenoid facet, and short proximo-distally; lower edge of furcular facet (posterior) well above glenoid facet, with abrupt median bend from glenoid to furcular area; procoracoid moderately prominent; antea intermuscular line not well formed middle of bone at its lower extremity; internal angle of sternal end well developed and pointed. In extent and depth of depression of neck and flare of head resemblance close to Phalacrocorax olivaceus, but distance from glenoid facet to tip of head relatively shorter, procoracoid less prominent and antero intermuscular line significantly more lateral in position, resembling in this latter respect only P. pelagicus.

Referred material: Distal end of left humerus, Lacm no. 3166 from type locality; collected by Leonard Beeson & Lacm party, May 6, 1955. Resembles P. olivaceus at distinguishes from P. pelagicus in more rounded and more deeply depressed distal terminus of impression of brachialis anticus muscle; distinguished from P. olivaceus by relatively smaller size; greatest breadth distal end 10.6 mm. (P. olivaceus 11.0–12.0 mm; P. pelagicus 12.1–13.3 mm) external depth distal end through external condyle 7.4 mm (P. olivaceus 8.1–9.2; P. pelagicus 8.4–9.8) internal depth distal end 8.8 mm (P. olivaceus 9.3–10.2; P. pelagicus 9.9–11.0). Ratio external to internal depth distal end 84% (P. olivaceus, 86–88%; P. pelagicus 89–91%)

$$
\begin{array}{r}
881 \\
10.1\overline{)8900} \\
\underline{808} \\
820 \\
\underline{808} \\
120
\end{array}
$$

$$
\begin{array}{r}
84 \\
88\overline{)7340} \\
\underline{704} \\
360 \\
\underline{352} \\
80
\end{array}
$$

$$
\begin{array}{r}
86.2 \\
102\overline{)8800} \\
\underline{816} \\
640 \\
\underline{612} \\
280
\end{array}
$$

$$
\begin{array}{r}
86.4 \\
96\overline{)8300} \\
\underline{768} \\
620 \\
\underline{576} \\
440
\end{array}
$$

$$
\begin{array}{r}
87 \\
93\overline{)8100} \\
\underline{744} \\
660 \\
\underline{651} \\
9
\end{array}
$$

projects ~~posteriorly,~~ producing an angular contour of the area when viewed extrnally; in group 2, P. pelagicus and P. penicillatus, the furcular facet terminates lower (nearer the glenoid facet) and there is little (P. penicillatus) or no (P. pelagicus) ~~posterior~~ flare. The anterior intermuscular line is more medially placed in group 1 than in group 2. The fossil, P. goletaensis, ~~xgr~~ is closr to group 1 in the character of the head and neck, but closer to group 2 in the position of the intermuscular line.

Nineteen fossil cormorants have been ~~previously~~ described from various geographic areas and from deposits of Oligocene, Miocene, Pliocene and Pleistocene age. Ten of these ~~species~~ were considered sufficiently distinct from species typical of Phalacrocorax today to warrant generic separation (Lambrecht, 1933: 290-~~297~~ 298). The distinctions were based on charactristics of the anterior intermuscular line of the coracoid. Although these distinctions are no longer recognized as generically significant, they suffice to separate these ten species from P. goletaensis, which shows no deviation from typical Phalacrocorax in the character of the intrmuscular line. Seven other fossil species were ~~xrx~~ markedly larger than P. goletaensis (from 28 to 80 per cent). The possibilities of relationship to previously described fossils narrows then to two species, P. leptopus Brodkorb from the Lower & Middle Pliocene of Oregon, and P. pampeanus Moreno and Mercerat, from the ~~late~~ Pleistocene of Argentina. P. leptopus is based on a tarsometatarsus for which only ~~a~~ measurement ~~of~~ is given "narrowest ~~tarsometatarsal breadth~~ width of shaft, 5.1 mm." ~~is given~~ (Brodkorb, 1961:71). This measurement compared with tarsometatarsal bradth in P. olivaceus suggests that P. leptopus was as much as 10-15 per cent larger than P. goletaensis. This supposition is further borne out by ~~the~~ ~~xixexofxthe~~ a referred specimen of coracoid, said to be larger than that of P. littoralis from the Oligocene of France, the coracoid of which is approximately 10 per cent larger than the type of P. goletaensis.

and there is littl

P. leptopus from the Pliocene of Oregon, and P. pampeanus from the Pleistocene (Pampean formation) of Argentina. Others are either markedly larger, or are distinguished by characters of the coarcoid sufficiently diagnostic as to have, at one time, been given generic value (Lambrecht, 1933:290-298). P. leptopus is based on a tarsometatarsus from the middle Pliocene; with referred specimens from the lower Pliocene, among the latter is a lower end of coracoid. This material has been loaned for this study through the courtesy of Dr. J.A. Shotwell of the Museum of Natu al History, University of Oregon. Both the tarsometatarsus and coracoid are considerably larger than these elements in P. olivaceus. Only the coracoid, of course, can be directly compared with P. goletensis. Although calipered measurements are difficult to make on the Oregon bone, owing to breakage, bone-to-bone comparisons indicate close size agreement with large individuals of P. pelagicus which are 20 per cent larger than the type of P. goletensis. Shaft dimensions at the narrowest part of the shaft as preserved in the coracoid of P. leptopus are 4.4 x 5.8 mm. At an estimated similar location on the shaft of P. goletensis (at the point of greatest antero-posterior bed) the dimensions are 3.5 x 4.6 mm. More significant than the size difference is the character of the internal angle of the sternal end and the development of the upper (posterior) lip of the sternal facet. In P. leptopus the sternal angle is blunt and the lip of the facet is large, both in lateral and posterior extent. In P. goletensis the angle is sharper, and the lip of the facet is relatively as well as actually smaller; in this latter character, the Mexican fossil resembles P. olivaceus, while P. leptopus is closer to P. pelagicus.

P. leptopus from the Pliocene of Oregon, and P. pampeanus from the Pleistocene (Pampean formation) of Argentian. Others are either markedly larger, or are distinguished by characters of the coracoid sufficiently notable to have, at one time, been given generic importance (Lambrecht, 1933:290-298). P. leptopus is based on a tarsometatarsus from the middle Pliocene for which the only measurement given is "narrowest width of shaft, 5.1 mm." (Brodkorb, 1961:71). This measurement, compared with the tarsometatarsal breadth of P. olivaceus, suggests that P. leptopus was as much as 15 - to 20 15/per cent

Most of the remaining nine species are immediately distinguishable from P. goletaensis on the basis of larger size: P. subvolans Brodkorb (Miocene, Florida), P. wetmorei Brodkorb (Pliocene, Florida) and P. macer Brodkorb (Pleistocene, Idaho) are 28-37 per cent larger; P. kennelli Howard, (Pliocene, California) is 47 per cent larger; and P. rogersi Howard (Pleistocene, California), P. idahensis (Marsh) (Pliocene, Idaho) and P. macropus (Cope) (Pleistocene, Oregon) are 60 - 80 percent larger. P. leptopus Brodkorb (Pliocene, Oregon) is based on a tarsometatarsus for which only a measurement of "Narrowest width of shaft, 5.1 mm." is given. This measurement, compared with tarsometatarsal breadth in P. olivaceus suggsts that P. leptopus was slightly larger than P. goletaensis, but this criterion alone is hardly reliable. Fortunately a partial coracoid is referred to P. leptopus. This is said to be larger than the coracoid of P. (Oligocorax) littoralis Milne-Edwards from the (Oligocene, of France) and is, therefore at least 10 per cent larger than the type of P. goletaensis. More reliable than this small size difference, however, is the character of the internal angle of the sternal end, which is "less produced than in other cormorants" (Brodkorb, op. cit:172). The illustration (op. cit: 171, fig. 1) also shows this angle to be quite blunt in comparison with the marked attenuation found in P. goletaensis. The anterior intermuscular line is said to be located as in P. wetmorei, which suggests a condition comparable to that of P. olivaceus and more mediad than in P. goletaensis.

P. pampeanus Moreno and Mercerat from (Pleistocene, Argentina) ~~may could~~ be within the size range of P. goletaensis. The South American species is known only from the type, a proximal end of humerus said to be slightly smaller than this element of "P. brasilianus" (= P. olivaceus) (Moreno and Mercerat, 1891:35) No measurements are given and the two views of the bone that are illustrated do not agree in size. Neither view, however, shows the specimen to be of lesser size than the minimum humerus of Recent P. olivaceus available here for comparison (Mus. of Vertebrate Zoolo., Univ. Calif., no. 126084, female from Mexico). The description of the fossil indicates slight distinctions from P. olivaceus. ~~On the basis of the~~ Lacking comparable specimens from Argentina and the Goleta formation, exact comparisons are impossible. In view of the fact that the South American Pampean beds, ~~from which P. pampeanus came~~, are considered to be of latest Pleistocene (Rancholabrean) age (Stirton, 1953:606), and thus approximately a million years younger than the Goleta formation, I believe it wiser to name the Mexican fossil as a separate species rather than ~~evenly tentatively~~ to allocate it to P. pampeanus, merely on the ~~basis of a possible agreement in size (which is actually subject to question)~~ of a questionable similarity in size.

Mio I
Plio III
Pleist III

Phoxiena

Chihuahua

Mexico

Lacm Contrib. Sci. II 94

April 4, 1964

Data from Lance, 1950?

Birds from Yepomera now publ HH 1964 Loeb

Mexico, Pliocene Rincon = Yepomera

Continental deposits exposed along the margins of the Valley of the Rio Papigochic, western Chihuahua, Mexico have yielded a large and varied mammalian fauna of Hemphillian stage of Pliocene (Stock, 1950)

Two locality names have been applied to the Chihuahuan middle Pliocene occurrences: Rincon was the first designation and was replaced by Yepomera, a more desirable place name for this faunal horizon, particularly because Rincon had been used for a stratigraphic formation or member. Stock describes a hyaenarctid bear from CIT loc. 275 "in the Arroyo Huachin, at Rincon, Chihuahua, loc. 275, CIT"

See Stock, 1948 "Uncovering the ancient life of Mexico," Eng. and Sci. Monthly, 11:29-31, for general discussion of these beds.

Other authors: Wilson, 1937, So. Calif. Acad. Sci. Bull 36:98-104, Lagomo.
Drescher, 1939, So. Calif. Acad. Sci. Bull. 38:57-62, new badger
Furlong, 1941 Carnegie Inst. Wash. Publ 530:25-33, new antelope
Miller, 1944, Wilson Bull. 56:77-82, new flamingo
Stock, 1948, Soc. geol. mexicana Bol. 13:69-76, badger
Lance, 1950 Univ. Nac. Autonoma Mexico Inst. Geol. Bol. 54:81pp., Equidae
Stock, 1950 So. Calif. Acad. Sci. Bull. 49:1-2. Bear

Information regarding the locality: Valley altitude 1800-2100 meters above sea level (from Lance, 1950); in western Chihuahua on the east side of the Sierra Madre Occidental. CIT localities 275, 276, 281, 289, 287, 295, 286, 291, 295, 297. Locs. are 150 kilos east of Chihuahua, and 300 kilos south of Columbus, New Mexico; total area of the valley is 100 kilos broad, narrowing at the north point; the town of Yepomera is in the north part of the valley, where the Rio Papigochic entrenches between the cerros of the Sierra Madre Occidental on its way to the Mar de Cortes. To the side of the valley (south of Yepomera) are the towns of Guerrero and Minaca, and near the latter are sedimentary strata, which in the campo designated capas Minaca contain a mammal fauna that evidently represents a Pliocene formation more recent that that of the Yepomera fauna.

The conjunto fosil Yepomera has been met in various localities from the small town of Matachic to the small town of Rincon de la Concha in the extreme north of the valley and approximately 30 kilos to the north of Matachic. With the exception of a few cases to be mentioned later, the fossiliferous localities contain essencially equal or equivalent faunas. The most prolific localities are in the vicinity of Yepomera and Rincon, and the canteras abiertas in these sites are taken as the exemples that have served principally for this study.

The relationship of the capas of the alrededores of Rincon and those mentioned of Minaca, that are younger paleontologically, is not known. In both places the strata lie horizontally. Remains of Pleistocene mammals have been encountered in gravas above the Pliocene capas in both extremes of the valley.

The fossil strata are sands, limes, arcillas and calcareous rock (caliza de agua dulce). in many niveles one finds volcanic ceniza. in some places lava is intercalated with the sediments. The predominant color of the fossiliferous beds is white or clear gray, but sometimes there are bands of green and red. The fossils are found principally in the arcillas and sands (tobaceas and calcareas), mostly without much induration. The bones occur in bolsas or lenses and are rotos and mezclados. much of the material is muestra afisado by water, but most part of the fragments of bone have aristas agudas, which insures that no hubo gran coas de transporte since the rompimiento. The most of the collections consist of teeth and limb

bones of horses. In some localities the material was preserved by silificiation, but in other places the bones have an aspect cretoso and se desmoronan and rompen. Crystals of calcite and quartz fill the medullary cavities of many of the limb bones.

The naturaleza of the yacimiento of the fossils and the general characterists of the sediments assure that they were deposited at the height of the zones of inundation, or vegas, of the rivers and in the places efimeros of the cuencas planas rodeadas of the cerros. Pray (geologist) says that one does not find evidence of fallamiento in the north of the valley. No obstante that this valley was at great elevation above sea level, relief is relatively very little noted. It is possible that the valley today does not differ greatly in appearance from the time in which the the fossils were deposited. It is believed that in the middle Pliocene the elevation above the sea was much less that today and that no existia drenaje exterior.

King, R.E., 1939, Geol reconnaissance in northern Sierra Madre Occidental of Mexico: Geol. Soc. Amer. Bull. 50:1625-1722, says: "Volcanic rocks of the principio of the Cenozoic extended over all the surface of the Sierra Madre Occidental. In the section of the altiplanicie od this province, the mesozoic rocks lying below, probably were strongly deformed. Sin embargo the deformation posteriores or post-volcinicthat expressed itself strongly further al poniente, slightly affected this region. The volcanic rocks are found horizontal or very slightly inclined, over great areas. Since its formation the superficie must have been raised more than a thousand meters by movments of the character more epirogenic (vertical) than orogenic (horizontal), so that a superficie of erosion antigus, desarrollada up to the madurez, extended over its superficie and esta now profoundly coratad by the cycle of erosion of today."

In the cercanias of Yepomera there are superficies of erosion cortadas overlying gravas of the Pleistocene and that are 30-60 meters over the present level of the river. Although there is not sufficient evidence to reconstruct the history of the drenaje, it is not improbably that the existence today is of relatively new origin. The cuenca that now occupies the Rio Papigochic could be cerrada and have contained mayor espesor of sediments before the agregarse of the system of the RioPapigochic-Rio de Haros-Rio Yaqui. The general system of drenaje of the valley, as it is reveals on topo maps by the fureza area of the Ejercito Emericanao, based on areaial photos, assures that the drenaba region to the south, ya sea que tuviera salida, or as is more probable that no la tuviera.

The above all from Lance, 1950, univ. Nac. Autonoma Mex. Instit. Geol. Bull. 54, viii +81 pp.

Rincon, mexico localities LT 276 and 289

(1) Phoenicopterus stocki

loc. 289	Prox + dist. ends tibiotarsi	recorded 3245, 4623
	2 dist ends "	unrecorded 4624, 4626
	2 " " humeri	recorded 4629, 4630
	1 frag dist end femur	unrecorded 4625
	1 prox. " ulna	" 4627
	1 frag prox + corpus	" 4628
loc. 276	dist. end humerus	unrecorded 4616

Rich breadth of tibiotarsi 12.9–14.8 (14.8 specimen is young)
" " humeri 19.1–21.9 (unrecorded fossil 276 between – 20.0)
Miller suggested in reading humeri that the large species range in size could justify placing all fossils in same species. The loc 276 humerus which lies at two extremes backs up this statement

(2) Branta ? Eremochen sp. unnumbered 9734

loc. 289 – scapula with only a small depression where large foramen occurs in geese usually. Otherwise bone is very similar to Branta canadensis (medium) If absence of foramen is valid for the species, it is a new sp.

Flamingo #9733

Loc. 289 – Distal end of radius. Similar to B. canadensis, but smaller

(3) Anas ? sp. (1) Teal size No #

Anas bumperi

Loc. 289 Right coracoid # 4621 – Teal-size in length but stockier, Sternal facet narrow as in Anas, not high as in Oxyura, and proportions above + below processes as in River Ducks rather than Ruddies or sea ducks

Try Chaitmetta

(4) Oxyura sp. Loc 289.

L 46.3 mm prox half ulna, very similar to O. jamaicensis (very little dorsally compressed palmar side of shaft, well excavated scar on ventral)

~~not prox end femora~~ see below ↓

(5) Ducks, sp. Loc. 289 – 2 femora, probably 2 species probably NOT Anas unnumbered possibly Oxyura OR Oxyura #9735, 9734

(6) Passerine inc. humerus 4622, loc. 289
Charadrius fem ~~frag~~ dist end ulna 4617, loc 276

(7) Sps? Loc 289 Prox end radius + inc scapula, ~~=Flamingo~~ (Casarka dist end rad, see above)

OVER

(8) Wascnaba new genus
~~Anas~~ new sp.?

(see Auk 1963 80(3):341-342 around
Weimar 1960 Smith Misc Coll. Blumida

Lx 284

Humerus 4620
Ulna 4619
Furcula 4618 (2 pcs)

Closely resemble Anas platyrhynchos but more slender, ulna longer furcula more V rather than U-shaped, Brachial impression very small as in A. platy.

Check on Anas diazi

Oxyura sp. LocCIT289

Ulna (prox $\frac{1}{2}$): ~~Ulna~~ attach. of brach. ant. deeply excavated forward anconal edge prox'ly, as in Ox jamaic ~~palmar face of shaft~~ and entire attachment ~~area~~ deepened so as to flatten internal surface of shaft ~~and~~ in palmar view shaft margins appear flat & narrow with angular int. border. Differs from O. jam. in barely clear intercotylar ridge (2 cotylae blend one to the other in O. jam.

	O. jam.	Rec, 1265 largest	Rec 851 smallest	Rec 888	referred valleculy O. rubida
Br. cotylae	5.7	6.2	5.65	5.8+	—
Depth prox from alec. thru ant. cot.	4.6	4.8	4.5	4.6	—
Br sh below brachial	3.0	2.9	2.7	2.7	—
Gr. depth	3.7	3.6	3.5	3.35	—
Br above 5th prf.	3.1	3.0	2.8	2.75	3.2 mid shaft at 5th?
depth " 5th "	3.7	3.5	3.2	3.25	3.7

Right & left prox ends femora (not mates)

Similar to Oxyura: ~~head~~ shaft little below head somewhat deepened so head area protrudes prominently. Deep deep muscle scar internal to obturator ridge pitted. Below this facet (not in all Rec. but in most, & in both fossils). Prox tip of trochl. broken in both specimens but appears ~~rounded~~ rounded bluntly as in O. jam.

	R	L	mi Rect fem	1265	
Br prox. to post. trochl.	8.4	8.7	8.1	10.0	8.8
Gr. post Br. prox	7.6	7.7	8.5	9.3	8.5
Br head	4.56	4.85	4.0	5.5	5.25
Gr. diam sh below trochl	4.7	4.4	4.5	4.4	4.6
Least " " sh	3.2	3.2	3.4	3.7	3.8

Main def. from O. jam is more oval shaped shaft (depth, patella is less

As both femur & ulna are not are not good diagnostic elements among the ducks, I deem it inadvisable to name the species here represented although there is little doubt that ~~are~~ it is an extinct sp., possibly O. rubidi, as the ulna is close in shaft br.

* p. 1a Insert on p. 1

Nine more bones are now at hand from locality 289

Teal coracoid from Ka 289 Mexico

Length to sternal angle	32.3	Nettion 31.1 – 35.0	Querq. 32.7 – 34.8 (discors) cyan 31 (this study)
Depth to br. shaft	94.1	76.4 – 90.1	79.4 – 81.4
Depth head thru brach. tub.	3.4	2.9 – 3.4	2.7 – 3.4
Ratio depth head/ht from scapfacet to head	33.2 %	26.4 – 31.1	24.1 – 30.8
Distance from top glenoid to ant. tip furc. facet	short 12.3 % length	17.9 – 19.8	18.5 – 19.2

Line from top of glenoid ambens to lowermost edge of furc. facet ant-ut, slopes slightly down → straight or slightly up →

Collated with posterior bend of coracohumeral surface above brach. tub. → gradually curving coracohumeral surface

Rabbit	Hyrax Rn. dist	Rabbit tubero-ischiad	Rn. dist tibia and dist fe	Hyrax tuberosity cond.
Recent rabbit unnumbered	Sam 24.9			7.1
" San D. Zoo	23.7			7.6
" Mitchell 89 ♀	21.0	11.8		6.5
" 235	23.65	12.9		6.8
" 1431	21.7	12.0		6.5
" 1295	21.6	12.2		6.6
" 1430	21.6	11.6		
Chelinda 1234	20.5	12.2		
antiq. 1499	23.7	13.1		
" 45	22.1	13.0		6.8
fossils 4630	19.2	11.3		
4629	21.9	12.1		
4614	20.0	11.4		
4624				6.0
4624				6.5

By dist tibia (fossil Lobo dist)
6.0 = 4626
6.5 = 4624

loc. 289 + 276.
Pliocene Rex
flamingos

$$192\overline{)219}\quad 1.14$$
$$+192$$
$$270$$
$$+192$$
$$880$$

$$216\overline{)249}\quad 1.15$$
$$216$$
$$330$$
$$216$$
$$1140$$
$$1080$$

Lu. 286 Duck Bones 4618, 4619, 4620

Ulna longer in proportion to humerus than in ducks 86.2%

Anas platyrhynchos 77.8 - 79.9%

Tadorna r Casarca 86.4 - 88.6

Branta nig.

Phacicoptenus stocki

				dulcius		Brunt P. rubra	
				1234	1295		
4627	ulna br. prox	13.6		14.6	15.0	1431-14.8	235 16.3
	depth int	11.2			11.8	12.2	13.2
fam loc 289	scaf, sh. to glenoid (sh. below acrom.)	10.4		11.2	11.2	11.0	12.6
fam loc 289	radius dist br	8.7		9.8	9.7	9.9	10.6
	prox. diam	5.9 x 7.3		6.2 x 8.2	6.1-8.1	6-8.1	6.8 x 8.6
4628	carpometa, br, hab	7.4			7.7		8.7

Yefornis materials

Lee, 286

Wasonaka study

Duck furcula (with humerus + ulna - which see other sheet)

#4618

Ulnae 4619

	a gr. depth symph. yes two pieces	ak. ant-post. for symph. distally	? depth mid symph to low, edge papilla	Ratio bar		Ht symph (one side 2 pieces)	ant-post depth symph (one side 2 pieces)	Ratio		Ratio ba		b gr. br. scar	depth mid scar int.	int. cotyl. trend of scar		ulna	femur	Ratio
fossil 4618	(4 small pcs.) 5.0	3.4	36.7	68.1	4618	4.8	3.4	71.0		19.5	%	2.8	14.3	18.6	1833 Cass	145.7	155.3	93.8
Anas pl. 219 ♂	6.3	2.8	38.8	44.4	219	5.3	2.8	52.9		34.2	219	3.9	11.4	15.9	Cass 1437	144.7	154.2	93.6
970 ♂	6.3	2.8	39.8	44.4	970	5.9	2.9	49.2		29.4	970	3.2	10.9	15.2	Branta 971	144.7	158.6	91.3
? 1286 ♂	5.2	2.8	36.5	53.8	1286	4.9	2.9	59.2		28.6	1286	3.1	10.8	16.2	Branta 1547	133.8	147.9	90.6
1214? ? 1286	5.4 5.2	3.2 3.0		57.2 57.4	1286	5.2	3.0	57.7		34.4	1286 (1) 1214	3.7	10.7 10.6	15.3 14.1	ansi 1835	118.2	125.8	94.2
1214 ♀	5.7	3.2	36.8	56.1	1214	5.6	3.2	57.2		31.7	1214 2	3.3	10.4	15.0	hisricus 1845	101.2	113.6	89.4
Tadorna 1703	6.0	3.5	40.3	58.3	1214 ♀	4.5	2.4	53.4		aver. 31.4 27.0	1703	3.0	14.3	18.3	Anser 878	138.4	148.8	93.3
1663	5.4	3.9	40.9	72.2				63796 549		23.1	1663	4.1	17.5	23.1				
Canimus? 1808	5.1	4.3		84.3						27.0 = 22.7 3.4	Cairina 16628 1808 dolichonyx 1826	4.5	16.6			103.1	129.8	79.6
? 1826	6.3	3.5		55.4								3.7	16.3					
Neochen? ?	4.4	3.6	42.6	81.7												radius? 112.5?	136.6	86.0?
? 1450	5.8	3.2	34.9	55.1											Tadorna 1703	87.7	101.8	86.3
1632	4.9	3.1		63.3											1663	105.9	119.3	88.5

Humeri ducks ratio length bicip. caput/deltoid caput Ratios

	X to head	a Length deltoid to tub.	Ratio a to X	c Length bicip to head	Ratio c to X	Length bicip to capital groove	Bx	✓	ca
Fossil 4620	28.4	23.6	25.4	20.7	22.4	16.6	74.0	88.1	— 70.3
Anasplat	28.6 (2) 28.0	23.1	24.7	22.7	24.3	18.1	81.2	98.1	— 78.5
" "	27.0 28.0	23.6	24.8	22.6	23.9	17.5	80.2	95.8	— 74.3
	12.14 (2) 27.1	22.4	25.1	21.4	24.2	16.9	79.0	96.4	— 75.6
	1286 (1) 29.4	24.8	25.4	23.7	24.8	18.3	80.4	95.4	— 77.2
	219 27.7	22.8	24.9	21.7	22.7	16.3	98.4	95.3	— 71.6
	12.14 (1) 27.0	22.3		21.3	23.4	16.5	79.0	96.0	— 75.4
Carnia nasicola	39.4	33.2	25.4	30.0	23.7	23.4	78.0	93.5	— 70.5
Sahidarius 1863	30.6	24.8	22.1	23.8	21.1	18.5	77.7	96.0	— 74.5
Tadorna 1663	36.1	29.6	24.8	26.6	22.3	21.0	79.8	89.9	— 71.0
1803	36.6			28.3			77.3		
" 1703	31.4	27.4	24.8	24.4	24.2	20.0	78.13	89.9	— 73.1
	1643	21.2		14.7			69.3		
Aix	1508	20.4	16.3	15.2		12.3	82.1	96.4	— 75.5
	2	21.4		16.5					
"	1728		18.1	17.3		13.8	80	95.5	— 76.3
"	1632	20.9		16.7					
Branta 1845	36.1	32.2	28.2	26.0	23.4	21.6	74.	82.9	— 67.0
1548	43.2	31.8	28.1	30.0	22.7	25.3	69.7	80.7	— 67.3
Dendrocygna 1645		25.5	—	20.6		16.9	—	80.7	— 65.3
688		22.6		18.5		15.5	—	82.0	— 68.4
1859		22.2		19.1		15.7	—	86.1	— 70.6

114 134.1 112.6

(130.2 / 164.0) 79.9

Wood Deed (all Spenser except as noted)

1028	1508
203 (2)	1643
	1635
gallon. 1632	
1728	2 gallon.
1753	985

1450 Baldpate
1452 Gadwall
1645 Dendrocygna
1859 11 javanica

Le Plume
Sc. 286 Mexico
Duck

	humerus a gr. length	humerus b gr br prox	humerus c length attach. br. tub.	humerus d Depth head NO impor.	humerus e length deltoid crest NO impor.	humerus b br dist end	humerus br shaft trans	humerus length biceps crest	ulna length @ to lat. cotyla	ulna gr length ulna	ulna c br across prox. coryla	ulna d min br shaft	ulna e Depth dist ext cond.	ulna b br dist facet	Ratio hum. ga	Ratio ulna hum.	Ratio hum. ca	Ratio ulna ca	Ratio ulna ea/da	Ratio hum bo
ulna 46619 hum 46620	92.6	19.7	7.8	6.8	22.6	14.0	6.4	20.7	79.7	86.5	9.7	4.8	8.9	5.9	6.9	86.2	7.8	12.1	11.1	21.3
Anas platy 219	95.3	21.3	7.4	7.8	22.8	14.9	6.9	21.7	74.4	81.0	10.4	4.9	9.1	6.0	7.1	78.1	7.7	13.9	12.4	22.3
970	94.9	20.9	7.6+	7.3	23.1	14.9	7.1	22.2	73.8	80.8	10.0	5.2	9.0	5.8	7.4	79.8	8.0	13.5	12.2	22.1
② 12860	95.1	22.1	7.7	7.5	23.6	14.8	6.55	23.7	74.9	82.2	10.1	4.9	9.3	5.9	6.9	78.6	8.1	13.5	12.4	23.2
② 12826	93.1	21.2	8.2	7.7	22.8	14.8	6.8	22.6	72.9	79.8	10.2	5.0	8.9	5.8	7.3	78.3	8.8	14.1	12.2	22.7
1 12149	91.6	20.2	7.2	7.5	21.7	13.9	6.7	21.2	72.5	79.4	9.7	4.8	8.4	5.1	7.3	79.4	7.8	13.3	11.6	21.9
2 12149	89.2	19.6	7.5	7.2	21.9	13.4	6.8	21.65	71.4	77.8	9.7	4.9	8.4	5.5	7.4	79.9	8.4	13.6	12.0	21.9
Anabasmicta K4699	90.8	19.5	6.0	6.8	21.1	13.7	6.6	19.9	80.2	86.3	9.3	4.6	8.5	5.8	7.2	88.4	6.6	11.6	10.6	21.4
K4692	98.3	21.0	6.4	7.4	23.4	15.1	7.0	21.8	89.3	95.8	10.3	5.2	9.2	6.0	7.1	92.1	6.5	11.5	10.3	21.4
Aver.	92.7	20.0	-	-	-	14.7	-		86.1	-	9.8	-	-	-	-	93.0		11.3	-	21.5
Tacoma 1703	101.8	21.5	5.8	8.1	26.5	15.5	7.4	25.0	87.7	94.6	10.8	5.1	10.2	6.0	7.2	86.4	5.7	12.3	11.4	21.1
1663	119.3	24.3	6.65	8.3	29.3	16.8	7.6	26.6	105.9	113.9	11.7	5.9	10.9	7.3	6.5	88.6	5.5	11.1	10.3	20.3
a. stepha 880	81.6	17.8			19.5			19.5	65.2	75.0						79.7				
881	86.45	18.0			19.7			19.3	68.9	75.3						80.6				
1452	84.4	17.5			19.5			18.3								78.3				
Anas 63	70.6								55.4	60.25										

* Measurements were taken from one side of furcular process. The unevenness of surface in this area in Anas may affect accuracy of the measurements.

Table of measurements of Wasonaka yepomerae n.sp. compared with Anas platyrhynchos

	Wasonaka	Anas platyrhynchos (6 specimen max.	aver.	min.
Furcula *				
Depth of symphysis (vertically)	4.8 ~~5.0~~	5.9 ~~6.3~~		4.9 ~~5.2~~
Anteroposterior breadth of symphysis	3.4	3.2 ~~2.8~~		2.8
Ratio of breadth to depth of symphysis	71.0 ~~68.1~~	59.2 ~~53.8~~		49.2 ~~44.4~~
Humerus				
Greatest length	92.6	95.3 ~~89.2~~	93.2	89.2 ~~95.3~~
Greatest breadth proximal end	19.7	22.1 ~~19.6~~	20.9	19.6 ~~22.1~~
Breadth distal end	14.0	14.9 ~~13.4~~	14.4	13.4 ~~14.9~~
Least transverse breadth of shaft	6.4	7.1 ~~6.7~~	6.9	6.7
Ratio b. sh. to length	6.9	7.5	7.3	7.0
Ulna				
Greatest length	86.5	82.2	80.1	77.8
Length to internal cotyla	79.7	74.9	73.3	71.4
Breadth across proximal cotylae	9.7	10.4	9.9	9.7
Breadth distal trochlae	5.9	6.0	5.6	5.1
Depth external condyle	8.9	9.3		8.4
Height ext. cond.	9.2	10.0		8.7
Ratio breadth prox. to length	21.3	23.2	22.3	21.9
Humerus same ratio	12.1	14.1	13.6	13.3
Ratio depth external condyle to length	11.1	12.4	12.1	11.6
Rat. ht. cond to long	11.5	13.3	12.9	12.0
Humerus Ratio to Ulna	86.2	79.9		77.8
Ulna Ratio depth to ht. ext condyle				

Humerus ratio prox end to length

" " dist " to length

Loc. 289 Plio. Mex

Teal coracoid (Right)

	to facet for lat. lig.	(a) to angle H	br free facet	(b) dist head to below scapular facet	dist head to tip process cor.	(c) Br below free facet	lateral Br shaft (lateral)	Depth shaft at same level where br taken	gr Br glenoid facet	br to 2 facets	Distance top of scapular facet to top glenoid facet	Depth below free facet	gr Depth head (thru coracoid tub.)	Br. neck bet. glenoid facet & free facet	Depth shaft scapular facet to ant. edge shaft	ant face bicipital groove to dist. edge free facet	Ratio ba	Ratio xy	Ratio ka	Ratio cb
A. velox ME	—	35.0	—	10.9	—	5.3	3.8	—	—	—	—	—	—	—	—	—	—	—	—	—
4621	31.9	32.3	4.6	10.3	8.5	5.0	3.3	3.2	3.7	6.9	4.2	1.3	3.4	4.7	4.8	5.6	31.9	96.7	17.3	45.5
Nebion ♂ 974	34.4	34.8	4.9	11.3	8.9	5.1	3.3	2.9	3.9	6.9	4.8	1.4	3.0	4.9	4.4	6.9	32.2	87.9	19.8	45.1
841 ♂	33.1	33.3	4.35	11.0	8.7	4.95	3.3	2.9	3.85	6.9	4.5	1.6	3.0	—	4.3	6.4	33.2	87.9	19.2	45.0
16846 ♂	32.15	32.8	4.2	11.0	8.8	4.9	3.3	2.8	3.7	6.8	4.5	1.6	2.9	4.2	4.2	6.4	33.4	84.7	19.5	44.5
♀ 842 ♂	32.8	32.9	4.7	11.3	8.9	5.0	3.5	2.8	3.8	6.8	4.3	1.7	2.9	4.2	4.3	6.3	33.1	80.0	19.1	44.9
1002 ♂	34.8	35.0	4.3	11.4	8.9	4.9	3.2	2.8	4.0	7.4	4.7	1.6	3.3	4.35	4.2	6.4	32.6	87.6	18.3	43.0
10038 ♀	31.0	31.1	4.8	10.5	8.5	4.5	3.0	2.7	3.65	6.9	4.6	1.4	3.1	4.6	4.1	5.9	33.7	90.1	18.9	43.7
15638 ♀	31.5	31.8	4.1	10.2	8.2	4.6	3.0	2.7	3.7	6.7	4.4	1.6	3.0	4.2	4.0	5.8	32.1	90.1	17.9	45.1
1006 ♀	32.0	32.3	4.3	11.0	8.7	4.7	3.2	2.8	3.75	7.3	4.8	1.2	3.1	4.5	4.1	6.0	34.9	87.6	18.5	43.5
1027 ♀	32.3	32.7	4.65	10.8	8.7	4.6	3.2	2.7	3.6	6.85	4.5	1.5	3.1	4.3	4.3	6.5	33.1	84.4	19.8	42.6
15628 ♂	35.1	35.4	4.8	11.94	9.1	5.3	3.8	2.9	4.1	7.8	5.0	2.0	3.4	3.0	4.4	6.6	33.2	76.4	18.6	45.3
15718	32.4	32.75	4.6	11.1	8.2	4.8	4.0	3.0	4.0	7.1	4.7	1.6	3.0	4.4	4.5	5.85	33.9	88.3	17.9	43.3
Nogemanea USNM 12833	—	36.4	4.5	10.8	8.8	5.2	3.4	3.1	3.5	7.3	4.8	1.4	—	4.6	5.0	5.3	—	—	—	48.2
♀ cyan. 8449	33.9	33.8	4.55	10.8	8.2	4.75	3.2	2.8	3.8	6.8	4.5	1.4	3.1	4.4	4.3	6.4	32.9	87.6	18.8	43.9
Mexico 14519	34.5	34.6	4.5	11.7	9.2	5.2	3.5	2.9	4.0	7.6	4.9	1.7	3.3	4.9	4.3	6.4	33.8	82.8	19.0	45.4
15579	33.8	33.9	4.6	11.3	8.9	5.0	3.7	3.1	4.1	7.1	4.9	1.8	3.2	4.6	4.65	6.3	33.4	83.7	18.5	45.3
1439	32.9	33.0	4.5	11.2	8.6	4.9	3.25	2.6	4.3	6.9	4.4	1.3	2.7	4.3	4.4	6.3	34.0	79.4	19.0	43.7
♀ discov. 15098	32.5	32.7	4.5	11.1	8.7	4.7	3.2	2.9	4.0	7.0	4.5	1.8	3.1	4.25	4.25	6.5	33.2	90.6	19.5	42.7
9338	34.5	34.8	4.6	—	8.9	5.1	3.6	2.9	4.2	—	4.6	1.6	3.1	4.4	4.4	6.2	—	80.5	19.2	44.5
♀ cyan.	32.7	32.9	4.3	11.0	8.3	5.0	3.6	2.7	3.9	7.4	4.6	1.4	3.3	—	4.4	6.4	32.4	81.3	—	45.5
~~8439~~	~~32.8~~	~~33.0~~	~~4.3~~	~~10.8~~	~~8.5~~	~~4.9~~	~~3.2~~	~~2.6~~	~~4.3~~	~~6.8~~	~~4.6~~	~~1.5~~	~~3.0~~	~~4.3~~	~~4.4~~	~~6.6~~	~~32.2~~	~~81.4~~	~~19.9~~	~~45.3~~

8,5
90) 765,0
720
500

90) 76

85,5
76) 650
608
420
380
400

Table of measurements of Teal coracoids (in millimeters) fossil ~ Recent

	LACM 4621	USNM 12833 Recent	A. crecca (11 specimens)			A. cyanoptera & A. discors* (5 specimens)		
			max.	aver.	min.	max.	aver.	min.
a. Length to internal angle	32.3	.....	35.1	33.1	31.0	34.5	33.8	32.5
b. Distance from head to below scapular facet	10.3	10.8	11.7	11.0	10.2	11.7	11.2	10.8
c. Breadth below furcular facet across trios-seal canal)	5.0	5.2	5.3	4.8	4.5	5.2	4.9	4.7
d. Breadth neck (measured on anterior face)	4.7	4.6	5.0	4.4	4.2	4.9	4.4	4.2
e. Distance from top of glenoid facet to internal edge of furcular facet	5.6	5.3?	6.9	6.2	5.7	6.7	6.5	6.3
Ratio b to a	31.9	...	34.0	33.1	32.1	34.0	33.3	32.0
Ratio c to b	48.5	48.2	45.1	44.1	42.6	45.4	44.1	42.4
Ratio d to e	84.0	86.7(?)	78.0	71.6	65.5	74.3	69.2	65.5

*As ~~measurements of~~ proportions in the coracoids of A. discors and A. cyanoptera agree ~~so~~ very closely, the measurements on the two available specimens of A. discors were combined with the four of A. cyanoptera. It is noteworthy also that in this element there is only a slight average distinction in size between A. crecca ("Nettion") and A. cyanoptera + A. discors ("Querquedula")

Table

Comparison of Coracoid LACM 4621, with USNM 12833 and Recent Teals

	LACM 4621	USNM12833	A.crecca	A.cyanoptera	A discors
a Length to internal angle	32.3	....	av. 33.1 31.0-35.1	33.8 32.9-34.5	32.5-34.5
b Distance from head to below scapualr facet	10.3	10.8	av. 11.0 10.2-11.7	av. 11.2 10.8-11.7	11.1- ?
c Breadth below furcular facet across triosseal canal)	5.0	5.2	av. 4.8 4.5- 5.3	av. 4.9 4.7- 5.2	av. 4.9 4.7- 5.1
d Greatest depth head, through brachial tuberosity	3.4	xxx	2.9- 3.4	2.7- 3.6	3.1- 3.3
e Breadth neck (measured from anterior face)	4.7	4.6	4.4 4.2- 5.0	4.5 4.3- 4.9	4.3 4.2- 4.4
f Breadth shaft below procoracoid	3.3	3.3	3.0- 3.8	3.2- 3.7	3.2- 3.6
g Depth shaft below procoracoid	3.3	3.3	2.7- 3.0	2.6- 3.1	2.8 2.9
Ratio b to a	31.9	—	33.1 32.1 - 34.0	33.3 32.0 - 34.0	33.2 - ?
Ratio c to b	48.5	48.2	42.6 - 45.1	43.9 - 45.4	42.4 - ?
Ratio d to a	10.5	—	8.6 - 9.9	8.1 - 9.5	8.9 - 9.3
h Distance from top of glenoid facet to internal edge of furcular facet	5.6	5.3?	5.7- 6.9	6.3- 6.6	6.5- 6.7
Ratio e to h	84	86.7	65.5 - 78.0	68.3 - 74.3	65.5 - 65.6
Ratio f to g	96.9	91.3			

~~6.4~~
6.6
63
~~6.3~~
~~6.5~~
67

6) 388 (6.46
36
28
24
40

66
63
67
319.6 (6.5
18
1.6

6) 415 (69.3 7162
36
55
54
15

6) 384 (64
36
24
24
00

11) 689 (62.6
66
29
22
70

5) 2207 (441
20
20
07
5
2

11) 4855 (441
44
45
44
11
11

Humeri of Leeds

Meganetta + Hymenolaimus

① entepicondyle less distally extended + less flaring than in other anatinae

② area for attach ext. head tricep more deeply + broadly excavated

? ③ deltoid crest reduced + more rounded, thus less angular at bend

④ bicip crest joins shaft at much wider angle

⑤ int tub. less produced anomaly + has distally directed flexure

? ⑥ ligamental furrow very shallow (not as in Hymenolaimus)

⑦ facet for ant. axis ligament less elevated than in Hymenolaimus

⑧ Brachial depression comes larger area than char. of tribe (but not deep)

Cairinii - reduced pneumatic fossa ruined with heavy bone. shaft area thickness 6.7-8.7 % length

(Plectropterus 5.7-6.3%)

Chenonetta Nettapus Chenoscopus

① Prox hd inflated to give more rhomboid appearance to shaft

② Deltoid crest more flaring

③ Head less prominent

NO ④ Pneumatic fossa domital view from int. view

⑤ ect epicond. elevated above entepicondyle (Sarkid + Amazonetta too) also as in Anatini (perhaps ect is higher)

⑥ Nettapus - chenonetta also (in addition to Neochen) have ⑤ entepi prominent distally produced + ⑥ facet for ant. axis ligament more flush with shaft than does Chenonetta

NO ⑦ The above 3 genera + aix, Dendronessa, Cairina + Pteronetta have indistinct depression of ext head of tricep along internal edge of ext. tubercle - the depression blends with the ext. part of the head

~~Amazonetta + Sarkidiornis~~

Yes ① Depression of ext. head of triceps is distinct + extends to ext tubercle as in dabblers (Anatini)

NO ~~② shaft straight in Sarkid~~

② Pneumatic fossa ovaloid

Sarkidiornis ① as above but ② is constricted & round

NO ③ shaft very straight

NO ④ ext tub. elevated distally so flare of rectord near parallel shaft

Wasmahai

✓ more excavated below head (anconally) than Aix & Carinira – Like Sarkidiornis

Pectoral attachment long & inclined to shaft distally

✓ as in Aix (Sarkidiornis rapid & short)

Head sloping gradually to Ext. tub. as in Aix; tub. prominently set off from head in Carinira & Sarkidiornis (also somewhat from in Anas

✓ Angulant of shaft anconally more than Aix & Carinira, less than Sarkidiornis, (more than Anas)

Deltoid crest defined externally as in Sarkidiornis (not in Anas, Carinira or Aix)

✓ Head less rectangular & capitate groove than Anas & groove more restricted (narrower)

Deltoid long rel. to bicip. crest as ——— ?

& takes off from sh. more abruptly (distinguishable) small & takes off from sh. more abruptly (distinguishable) small int. condyle a more rounded ball (not oval in Anas) close to Sarkidiornis & Aix – This restricts the intercondylar groove more than the oval condyle does

Dist. brach aut. small oval about as in Anas

Shape ↑ as in Aix but rel. smaller Sarkidiornis rounder

Carinira more boxy

Ectepicond prox. juts out from shaft more abruptly than in Anas (like Sarkidiornis & Aix)

CIT LOC. 286 Yepomera Humerus no. 4620 = Wasonaka yepomerae n. sp. n. sp.

Chief characters (see Woolfenden p. 109)

Anatinae:

1. Capital shaft ridge lacking
2. Capital groove deeply excavates head laterally
3. Dep. ext. head of triceps extends laterally
4. Area of pectoral attachment on ext. tub. elliptical and tipped distally.

Anatini:

1. Area of origin of external head of triceps broad (extending to pectoral attachment on int. tub. and undercutting head in broad crescent (narrower, not reaching tub. in Tadornini).

Tadornini (tending toward geese)

1. Deltoid crest, external surface depressed below heavy bordering rim as in Tadornines, but less depressed than in geese; distinguished from Anas in which the ext. surface is slightlly inflated. Heavy proximal rim is slightly undercut on palmar side by deeply depressed bicipital furrow. This condition is closest to specimen no. 1703 (then 1663).
2. Distally crest joins shaft at a more abrupt angle than in Anas and this point is lower on the shaft with respect to the distal limit of the bicipital crest than in Anas.
3. Capital groove between head and internal tub. relatively narrow. Internal profile of head slightly overhangs the groove as in Anas, as viewed diagonally from palmar side with bone slightly tilted so that internal side is uppermost.
4. Impression of brachialis anticus a small moderately depressed oval siauated as in Anas; other contours of distal end also as in Anas.
5. Intermuscular line on palmar surface immediately below bicipital crest bordering extreme internal edge of shaft as contrasted with Anas in which it is set medial to the edge of the shaft. Condition more as in geese and tadornines.

Furcula no. 4618

1. Similar to Anas in position of intermuscular line on ext. surface of clavicles and well-developed coracoidal papilla; furcular process about same development as in Anas but less ventrally protruded.
2. Distinguished from Anas in symphysial area: dorsal surface of symphysis straighter and thicker, inclined slightly posteriorly so as to be visible in posterior view; posterior and dorsal surfaces froming angular contour rimming symphysis posteriorly except for slight gap at midpoint (1mm. approx.); faint lines extending downward on either side of "gap" to join furcular process; anteriorly surface of symphysis flattened, lacking slight concavity of horizontal contour found in Anas. (In Anas the posterior dorsal border is rounded and a single line leads to the process; the entire symphysis is straighter in the fossil, in Anas there is a slight slope of the symphysis on the anterior side with a tendency for slight concavity of anterior contour at the midpoint at least at dorsal edge (anterior surface is straight in fossil, and is gooselike in this respect.
   Fossil has prominent papilla-like coracoidal process at upper end of each clavicle.

CIT LOC. 286 Ulna no. 4619

In general contours as in Anas but distinguished as follows:
Papilla on palmar surface below long distal tip of external cotyla more prominent and impression of brachialis anticus muscle longer;

Area on external edge of palmar side of acromion markedly excavated and external cotylar border extended anconally to end in a small pit at the edte of this excavation.

Entire element longer and relatively more slender
Distal external condyle less proximally extended
Impression of brachialis anticus muscle longer, narrower, and less depressed
External cotyla serves to extend the cotylar area farther towards olecranon
Intercotylar area more compressed in this area
Ligamental attachment on external side of olecranon markedly produced onto palmar surface of olecranon
Note that compression of intercotylar area is reflected in narrower intercondylar area (less depressed) of humerus anconally.

Measurements and ratios

	Ulna, length impression brach. anticus	gr. br. same	ratio br to length	ht. extcond.
fossil 4619	14.0mm.	3.3	23.6%	9.2mm
Anas 219	11.9	3.7	31.0	
"1214 (A)	11.3	3.4	30.1	
" " (B)	11.3	3.2	29.2	
"1286 (A)	11.9	3.7	31.1	
"1286 (B)	11.4	3.4	29.8	
" 970	11.35	3.3	29.1	
Aix 1635	9.5	2.8	29.4	
Tadornine 1663	17.9	4.2	23.4	
" 1703	14.0	2.9	20.7	
Fos. Lake 3546	14.4	3.9	27.1	
? 881	9.6	2.9	30.2	
880	10.3	3.3	32.0	

	Humerus, internal condyle Depth	breadth	ratio br. to depth
fossil 4620	4.85	5.1	95.1%
Anas 1214(A)	5.3	6.0	88.4
" 1214(B)	4.8	5.5	87.3
" 1286(A)	5.1	6.0	85.0
" 1286(B)	5.1	5.75	88.7
" 219	5.1	6.1	83.6
" 970	5.2	6.0	86.7
Aix 985	4.0	4.8	83.3
" 1508	3.8	4.3	88.4
" 1632	3.9	4.4	88.7
" 1635	4.0	4.8	83.3

Wasonaka gilpinorae n. gen. n. sp.

Duck from CIT Loc. 286

Discussion: The combination of anteroposterior thickening of the symphyseal area with the presence of papilla-like coracoidal tuberosities on the clavicles is found among the perching ducks. The charaxters of angular junction of the dorsal and posterior surfaces of the symphysis and the double lines connecting with the furcular process are found in Sarkidiornis. The more posterior than ventral development of the furcular process, the straight anterior surface of the symphysis and the distinct V-shape of the element are all distinctive of Wasonaka alone. The coracoidal tuberosities resemble those of Aix and Sarkidiornis, (the one available specimen of Cairina is very young and lacks tuberosities) but are not as markedly developed as in Anas.

In the humerus, the external depression of the deltoid crest noted in the fossil occurs also in Sarkidiornis, though in general this is a feature more characteristic of the tadornines. The length and prominence of the pectoral scar vary among the ducks; the scar is much shorter and more anconally projected in Sarkidiornis; the condition in the fossil is more like that found in Aix or Anas, though the external tuberosity is slightly less developed than in the latter genus. The moderate curvature of the shaft, small oval impression of brachialis anticus with prominent angular profile of shaft above the external condyle are all characters found in Anas.

The long, narrow bicipital attachment of the ulna is in general more typical of the geese though it occurs, as well, in Tadorna. The ulna of the specimen of Sarkidiornis at hand is incomplete, but both Aix and Cairina, as well as Anas, have a relatively short, broad attachment.

In ratio of ulnar to humeral length the fossil also agrees with Tadorna. Ratios are as follows (length of ulna taken to internal cotyle): Wasonaka 86%, Aix 74-78%, Anas platyrhynchos 78-80%, Cairina 79%, Tadorna 86-88%, and in a sampling of five species of geese 89-93%.

In all comparisons with recent anatids that it has been possible to make, the number of features in which Wasonaka resembles the perching ducks are predominant. The new genus is, therefore, assigned to the Cairini.

Cormorant from Goleta

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and

Chihuahua avifauna

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